# The San Jose Computer Collection and Recycling Pilot

The U.S. Environmental Protection Agency
Common Sense Initiative
Computers and Electronics "Overcoming Barriers" Workgroup

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# Table of Contents

# Table of Contents, continued

## Appendices

## Tables and Figures

### Tables

### Figures

## Acknowledgments

# Executive Summary

## Background
During the month of October 1997, used computer equipment was collected from consumers in San Jose, California, as part of a pilot project supported by the U.S. Environmental Protection Agency (EPA)'s Common Sense Initiative. The goals of the pilot were to determine the feasibility of collecting equipment at consumer retail stores, identify potential barriers related to the use of such industry partnerships, and determine a set of economics for collecting consumer equipment through this approach.

For the pilot, used computer equipment (e.g., laptops, personal computers, hard drives, printers, etc.) was dropped off by consumers at one of three participating electronic equipment retail stores. A minimum of once per week, collected equipment was picked up by the equipment recycler, labeled and transported to the recycler's processing facility. There, equipment was sorted for resale or material recovery. Computer equipment destined for resale was placed in a weekly auction area, and if sold, the revenue was recorded. Unsold equipment was dismantled to an appropriate level, with materials sorted into different scrap material categories. The scrapped materials were then sold into appropriate markets (e.g., aluminum, circuit boards, mixed metals) and/or given to recyclers for further processing (e.g., monitors, plastic).

## Data
Computer equipment was collected for five weeks from October $1^{st}$ through November $2^{nd}$. A total of 4,220 ft$^3$ or 61,600 pounds (30.8 tons) of equipment was collected. Of the total 61,600 pounds, approximately 90% was not resalable and had to be "scrapped," or processed for material recovery. Over 30,000 pounds (49% of the total collected weight) were black and white computer monitors that could not be resold. After processing the other 25,000 pounds of nonresalable equipment, steel represented the largest commodity by weight, representing just over 20% of the total weight of collected equipment. Printed circuit boards represented less than three percent (3%) of the total weight.

A total of over 2,800 pieces of computer equipment (e.g., CPUs, monitors, and keyboards) were collected during the San Jose pilot. In number, CPUs represented 35% of collected equipment, black and white monitors represented 33% and printers represented 15% of all collected items. Laptops only represented one percent (1%) of the total mix of equipment.

Revenue received from the used computer equipment fell into two categories:
  (1) revenue associated with the resale of the equipment and/or equipment parts; and
  (2) revenue received from the sale of related scrap materials (e.g., aluminum, copper, wire, unpopulated circuit boards).

The total resale value of the equipment was $1,940.50 while the scrap value of the recovered materials was $3,179.50. Thus, out of the total revenue of $5,120, 38% was generated by equipment resale while 62% came from the sale of scrap material. The majority of the resold equipment was black and white computer monitors. A total of almost $1200 was received for the 95 resold monitors. The 95 monitors, however, represented only ten percent (10%) of the total number of monitors received during the pilot; the rest of the monitors were recycled.

Costs for the San José pilot included:
- transportation costs;
- processing (i.e., sorting, dismantling, and material separation) costs; and
- monitor recycling costs.

Transportation costs for the pilot were $480. These costs were based on a total number of 20 pickups and a roundtrip driven mileage of 360 miles. Processing costs for the San Jose pilot were $7,500. These costs included sorting the received equipment, dismantling the nonresalable equipment, and separating differing materials for material recovery.

Because the pilot's recycler had a unique, low-cost capability for recycling computer monitors, two separate sets of monitor recycling costs were used for the pilot. The recycler's method (recycling the monitors in China) cost $0.05 per pound while the cost for recycling the monitors in the U.S. ran ten times higher, or $0.50 per pound.

Due to the significant difference in monitor recycling costs, two net economic scenarios were calculated for the San Jose pilot. The net economics for the first scenario (with the monitors recycled in China) came to a program cost of $4,373, or $142/ton. The net economics associated with the second scenario (monitors recycled in the U.S.) reached a cost of $17,990, or $584/ton. Of these two economic scenarios, the second ($584/ton) is probably more representative of typical U.S. collection and recycling costs since recycling of monitors through U.S. processors is more commonly used by U.S. industry and governmental agencies.

**Publicity**
Several months prior to the collection pilot, publicity contacts were identified and solicited for support. Numerous groups expressed willingness to provide publicity for the collection event. Despite this willingness, timing and competing marketing messages prevented most of the publicity from occurring.

This experience provides useful guidance for future collection events. A lesson learned in the San Jose pilot is that marketing efforts should be established at least six months in advance and should be monitored regularly prior to and

throughout the collection event. Because of competition for free publicity, it is reasonable to assume that only a fraction of marketing efforts will actually be publicized.

Despite the lack of *prior* publicity for the pilot, a successful press event was hosted by the U.S. EPA several days after the start of the pilot. Coverage of the press event appeared on the local news and on the front page of the local newspaper. Although no measurable amount of computer equipment was collected prior to the press event, the week following the press event, over 1,100 ft$^3$ of equipment was collected.

Additional publicity about the pilot was conducted by one of the participating retail stores. Three times per week throughout the month of October, one of the stores ran a small advertisement about their participation in the pilot. This store collected ten times more equipment than both of the other two stores combined.

**Barriers**

A few days before the start of the pilot, a state environmental agency determined that a permit variance was required for collecting and managing the used computer equipment because the state considered the equipment a "non-RCRA hazardous waste." Although the permit variance was successfully obtained, this last-minute government requirement almost stalled the entire project.

Because of environmental regulation and regulatory related costs, the recycling of CRT-containing monitors was identified as creating barriers for the recycling of computer equipment. Due to the lead content in color CRTs, discarded CRTs are often regulated as hazardous waste. Although some black and white CRTs and CRTs generated by households and small businesses are not usually regulated as hazardous waste, the CRTs must typically enter the same recycling infrastructure established for regulated CRTs. Because of CRT regulation, this infrastructure includes additional handling, transportation, processing and documentation costs. Since monitor recycling costs were found to pose the largest portion of computer equipment recycling costs, the recycling of CRT-containing monitors becomes a significant barrier to the recycling of computer equipment.

Another barrier encountered was reaction to a voluntary pilot survey form. To collect consumer data, a one page, graphically pleasing survey form was designed. The form was to be completed by each consumer participating in the pilot. To reduce store personnel time, an effortless process was designed for providing and collecting the forms for consumers. The form requested very little but very important information (i.e., four questions).

Unfortunately, one store decided to not use the forms. A second store placed the forms in an area where the form was partially hidden behind merchandise. Because forms were only completed at one retail store, the answers provided

were not considered representative of all consumers participating in the study. Thus, reaction to use of a voluntary survey became a barrier to the collection of useful data.

An additional barrier encountered was a lack of corporate support at two of the retail stores. At these stores, regional management prohibited expenditures for advertisement of the pilot and prohibited placement of the equipment collection boxes in plain view of store customers. Although local store management supported the collection pilot, corporate management instituted restrictions that decreased the visibility of the pilot.

By contrast, the third store had corporate management that fully supported the collection pilot. For example, the store's corporate management moved their computer equipment collection box from behind the store's customer service station to a prominent location just inside the entry to the store. Above the box, a large sign titled "Recycle Used Computers" was hung. The contrast in levels of corporate support between stores was reflected by a ten-fold difference in the amount of equipment collected.

## Conclusions
The large amount of material collected during the San Jose pilot shows that it is possible to collect large volumes of used consumer computer equipment through retail stores. However, substantial costs were incurred for recycling the equipment, primarily due to high costs associated with recycling the computer monitors. The cost for recycling the computer monitors ranged from $0.05 to $0.50 per pound, while the net economics for collecting and recycling all collected computer equipment ranged from a total cost of approximately $4,400 to $18,000 (i.e., $0.07 to $0.29 per pound). Although the overall cost for recycling was substantial, it was still lower than costs which could have been encountered if the computer monitors had been disposed as hazardous waste and the remaining equipment had been landfilled.

During the study, dramatically different costs were identified for the recycling of computer monitors. This demonstrates that there is not a singular set of economics for computer equipment recycling. Additionally, the pilot economics do not include non-quantifiable benefits associated with the recycling of the computer equipment (e.g., increased publicity for project partners, enhanced government/industry/public relations, new business opportunities, enhanced environmental protection). Non-quantifiable benefits to program partners and the public in general should probably be considered in evaluating the success and viability of consumer electronic equipment collection and recycling programs.

# 1.0 Background

## 1.1 EPA's Common Sense Initiative

The EPA 's Common Sense Initiative (CSI) was established to encourage the use of common sense, innovation and flexibility to achieve a cleaner environment at less cost. This goal is often characterized as finding "cleaner, cheaper and smarter" approaches to environmental regulation. In 1995, the EPA established a CSI Computers and Electronics Sector Subcommittee to examine a wide range of issues affecting the electronics industry. A workgroup of this Subcommittee is addressing issues (including regulatory barriers) associated with electronic product reuse and recycling. This group has funded several pilot electronic equipment collection projects as a way to identify the most feasible and cost-effective mechanism(s) for collecting and recycling electronic equipment from the public.

## 1.2 The San Jose Computer Collection and Recycling Pilot

Most of the EPA CSI-funded electronic equipment collection pilots were designed as single day events utilizing single collection points. Until the San Jose pilot was initiated, none of the pilots utilized retail stores or other private industry locations for the collections. In April of 1997, a CSI industry representative (from Unisys Corporation) began discussions about coordinating a computer collection event that would fully utilize industry partners. San Jose, California, was chosen for the location of the collection event.

## 1.3 Project Goals and Report Focus

The goals of the San Jose Computer Collection Pilot were to:
- determine the feasibility of collecting, transporting and recycling used computer equipment from the public using a private industry model;
- determine potential economics of the computer collection program; and
- identify issues associated with using private industry partners for computer collections.

This report not only evaluates data collected through the pilot but also strives to provide a broader perspective on the range of options for managing used computer equipment. The report presents data for several other computer equipment management scenarios to allow comparison with the San Jose pilot data. Although the regulation of computer cathode ray tubes (CRTs) appeared to impact some of the data collected in the pilot, this report is not intended to, and does not fully describe regulations pertaining to CRTs. Rather, data collected during the pilot is described within the context of current CRT regulation.

## 1.4 Project Partners

Partners involved in the San Jose pilot included:
- Unisys Corporation, which identified and solicited partner participation in the event and shepherded resolution of regulatory and process issues;

1

- U.S. EPA which provided funding for analysis of the pilot data and hosted a major press event for the pilot;
- Berman's Diversified Industries, a San Jose recovery/resale/recycle service provider ("recycler"), which processed the used computer equipment and provided volume and economic data for the study;
- the Environmental/Recycling Hotline, a public/private partnership that maintains a database and web site providing geographically specific recycling information to the public. The Hotline assisted with marketing messages and artwork for the pilot and provided consumers with information about the pilot through the Hotline's 1-800 telephone number and Internet website; and
- three electronic equipment retail stores: Computer City, Fry's Electronics, and OfficeMax, which served as used computer equipment collection locations. Throughout this report, these stores are referred to as Stores A through C (although not necessarily in this order).

## 1.5 San Jose Demographics

San Jose is located in Santa Clara County, approximately 56 miles southeast of San Francisco. It is 174 square miles in size, considered a center for high-technology companies, and described as the capital of Silicon Valley. Other cities in Santa Clara County include Milpitas, Cupertino, Sunnyvale, and the city of Santa Clara. In 1994, San Jose had an estimated population of over 873,000 and the residents had a median household income of approximately $50,000. As of January 1, 1995, Santa Clara County had a population of just over 1.6 million.

## 2.0 Methodology

For the San Jose pilot, used computer equipment (e.g., laptops, personal computers, monitors, keyboards, hard drives, circuit boards, printers, etc.) was dropped off by consumers and/or small businesses at one of the three participating retail stores during the month of October. A minimum of once per week, collected equipment was picked up by the equipment recycler at each retail store, labeled and transported to the recycler's processing facility. There, equipment was sorted for resale or material recovery. Computer equipment destined for resale was placed in a weekly auction area, and if sold, the revenue was recorded. Equipment not sold (and equipment originally designated for material recovery) was dismantled to an appropriate level, with materials sorted into different scrap material categories. The scrapped materials were then sold into appropriate markets (e.g., aluminum, circuit boards, mixed metals) and/or given to recyclers for further processing (e.g., monitors, plastic). A graphic depiction of the process is provided below.

*Figure 2.0: San Jose Pilot Process*
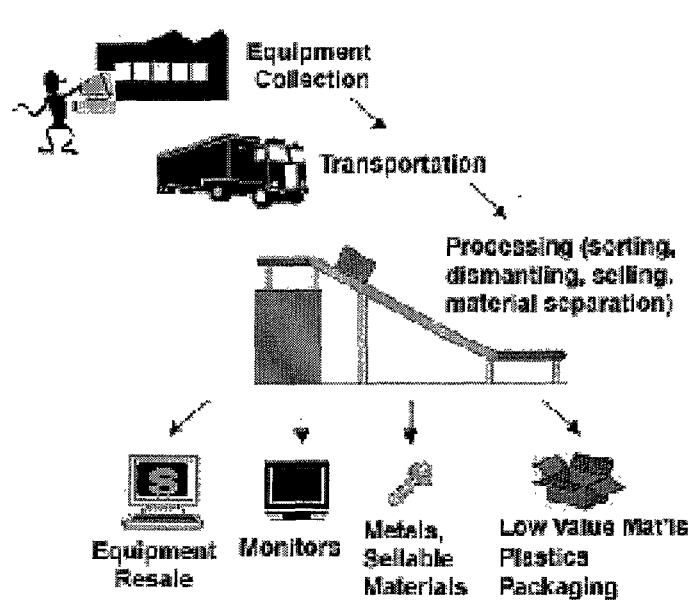
# 3.0 Equipment Characterization

## 3.1 Equipment Volume

Computer equipment was collected for five weeks from October 1st through November 2nd. The volume of equipment collected per week is shown below. Equipment was stacked approximately four feet high on four foot by four foot (4' x 4') pallets, resulting in an estimated 64 cubic feet of equipment per pallet with a total of 4,220 $ft^3$ of equipment collected during the pilot.

*Table 3.1: Computer Equipment Volume Per Week*

| Week | Dates | No. Pallets | Volume (ft$^3$) |
|------|-------|-------------|-----------------|
| 1 | 10/01 - 10/05 | 0 | |
| 2 | 10/06 - 10/12 | 18 | 1150 |
| 3 | 10/13 - 10/19 | 13 | 830 |
| 4 | 10/20 - 10/26 | 14 | 900 |
| 5 | 10/27 - 11/02 | 21 | 1340 |
| Total | | 66 | 4,220 ft$^3$ |

The volume of equipment collected in the San Jose pilot can also be depicted as shown below, with the distribution of equipment collected per retail store per week.

*Figure 3.1: Pallets of Computers per Store by Week*
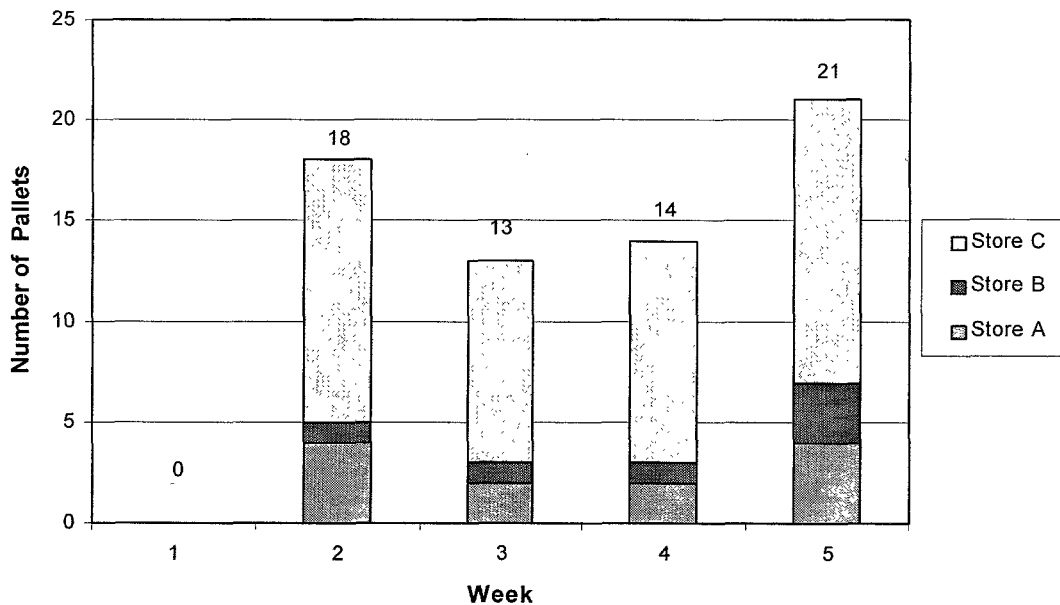


The volume of equipment collected per week will be discussed in relation to pilot publicity in Chapter Five: Marketing and Publicity.

## 3.2 Equipment Mix

The number of pieces of computer equipment collected during the pilot is shown below. The percent of received equipment that each type of equipment represents is also shown.

*Table 3.2: Computer Equipment Received*

| Type of Equipment Collected | No. Items | Percent |
|---|---|---|
| CPU's | 972 | 35 |
| Monitors (black & white) | 937 | 33 |
| Printers | 413 | 15 |
| Keyboards | 341 | 12 |
| Peripherals (mouse, hard drives, cables, etc.) | 66 | 2 |
| Misc. Parts (circuit boards, fans, etc.) | 63 | 2 |
| Laptops | 27 | 1 |
| *Total* | *2,819* | *100* |

Among the mix of computer equipment collected, CPU's accounted for 35% and monitors (all were black and white) accounted for 33% of the number of items collected. Laptops only represented one percent (1%) of the total mix of equipment.

## 3.3 Equipment Weight

A total of 61,600 pounds (30.8 tons) of computer equipment was collected during the month-long San Jose pilot. Of the total 61,600 pounds, 30,260 pounds were computer monitors that were not sellable and were processed for material recovery. Besides the monitors, an additional 25,180 pounds of materials were managed for scrap value. For each type of material, the percentage of the total weight of all equipment collected is provided below.

*Table 3.3: Scrapped Material as a Percent of Total Collected Weight*

| Scrapped Material | Percent of Total Weight |
|---|---|
| Monitors | 49.1 |
| Steel | 20.1 |
| High Grade "Breakage" | 9.8 |
| Mixed Metals | 3.1 |
| Plastic | 3.0 |
| Printed Circuit Boards | 2.7 |
| Wire | 1.2 |
| Other (packaging, etc) | < 1 |
| *Total Scrapped Material* | *90 %* |

As shown above, scrapped steel accounted for just over 20% of the total weight of collected equipment. Almost ten percent (10%) of the weight went into a mixed metal category called "high grade breakage." This category included nonresalable hard drives, motors, and mixed metal parts. Approximately 90% of all equipment received (by weight) was sold for scrap value, while only ten percent (10%) of the equipment (by weight) was resold. Information on resold equipment is provided in Section 4.1: Revenue.

## 4.0 Economics

### 4.1 <u>Revenue</u>

Revenue received from the used computer equipment fell into two categories:
- (1) revenue associated with the resale of the equipment and/or equipment parts; and
- (2) revenue received from the sale of related scrap materials (e.g., aluminum, copper, wire, unpopulated circuit boards).

The total resale value of the equipment was $1,940.50 while the scrap value of the recovered materials was $3,179.50. A total of $5,120 in revenue was generated from recycling and resale of the collected equipment. Thirty-eight percent (38%) of the revenue was generated by equipment resale while 62% came from the sale of scrap material.

#### 4.1.1 Value of Resold Equipment and Parts

Because of the old vintage of most of the received equipment (the majority of computers were 286s), no CPUs or laptops were successfully resold as working units. The majority of the equipment resold – both in numbers and in dollars - was black and white computer monitors. A total of almost $1,200 was received for 95 resold monitors. The 95 monitors, however, represented only ten percent (10%) of the total number of monitors received during the collection pilot (the remainder of the monitors were processed for material recovery).

#### 4.1.2 Value of Scrap Material

The largest amount of material recovered from the dismantled equipment was steel but because of its low value, no money was received for this material. Over $1,300 was received for scrap circuit boards, and over $1,500 was received for high grade breakage. This category included nonresalable hard drives, motors, and mixed metal parts. The highest per-unit financial return among the scrap materials came from printed circuit boards, which averaged revenue of $0.82 per pound.

#### 4.1.3 Summary of Revenue

A listing of revenue for different equipment and scrap materials is provided in the tables below. The total amount of revenue generated from used computer equipment collected in the San Jose pilot is $5,120.

Table 4.1.3.1: Equipment Sale          Table 4.1.3.2: Scrap Material Sale

| Source of Revenue | Revenue | | Source of Revenue | Revenue |
|---|---|---|---|---|
| CPUs & Laptops | - | | Steel | - |
| Keyboards | - | | Plastic | - |
| Monitors      (95) | $ 1,179.50 | | Mixed Metals | $ 205.10 |
| Printers       (30) | $ 286.00 | | Wire | $ 110.40 |
| Hard Drives (2) | $ 26.00 | | Printed Circuit Boards | $ 1,347.25 |
| Misc. Parts (40) | $ 449.00 | | High Grade "Breakage" | $ 1,517.25 |
| | | | | |
| Equipment Revenue | $ 1,940.50 | | Scrap Material Revenue | $ 3,179.50 |

Table 4.1.3.3: Total Revenue

| Source of Revenue | Revenue | Percent of Revenue |
|---|---|---|
| Equipment Sale | $ 1,940.50 | 38 |
| | | |
| Scrap Material Sale | $ 3,179.50 | 62 |
| | | |
| Total Revenue | $ 5,120.00 | |

## 4.2 Costs

Costs for the San Jose pilot included the following:
- transportation costs;
- processing (sorting, dismantling, material separation) costs; and
- monitor recycling costs.

Because members of the public delivered their used computer equipment to the participating retail stores, there were no collection costs measured in the study.

### 4.2.1 Transportation Costs

Transportation costs for the pilot were $480. Costs included in the study were limited to the cost of standard loading and unloading time (i.e., labor costs) and physical transportation of the computer equipment from the collection sites (retail stores) to the equipment recycler. Transportation costs used in the analysis do not include excessive labor costs encountered in moving the computer equipment from the retail stores to the recycler's truck. This latter item is of note because at one of the retail stores, equipment had to be removed from the store through a narrow front entrance rather than through a loading dock. Removing the equipment in this manner required individual handling of equipment, which increased transportation costs by 62%. To provide standardized data for extrapolation to other studies, this increased cost is not included in the reported transportation cost.

8

Computer equipment was picked up at each of the retail stores once per week for each of four weeks (no pickups were required at the end of the first week). Store C required two additional pickups per week. Therefore, the transportation costs are based on a total of twenty pickups. The total transportation costs for the San Jose pilot are based on the following roundtrip distances:

Store A to Recycler: 30 miles     Store B to Recycler: 30 miles
Store C to Recycler: 10 miles

Thus, the $480 transportation cost is based on a total number of 20 pickups and a roundtrip driven mileage of 360 miles.

### 4.2.2 Processing Costs (Sorting & Dismantling)

Processing costs for the San Jose pilot were $7,500. These costs included sorting the received equipment, dismantling the nonresalable equipment, and separating the differing materials for material recovery. Processing costs are thus essentially labor costs for determining how to manage the equipment for maximum revenue.

### 4.2.3 Monitor Recycling Costs

Because the pilot's recycler had a unique, low-cost capability for recycling computer monitors, two separate sets of monitor recycling costs were calculated for the pilot. The recycler's method (recycling the monitors in China) cost $1,513 while the cost for recycling the monitors in the U.S. ran $15,130. This difference resulted from a $0.05/lb cost for recycling monitors in China compared to a $0.50/lb cost for recycling monitors in the U.S.

The significant difference in the monitor recycling costs is probably best related to three factors:
1) differences in monitor dismantling and processing costs;
2) differences in demand for reuse of computer monitors; and
3) differences in acceptable waste disposal practices between the U.S. and China.

Typical monitor recycling includes separation of the CRTs from other monitor parts. This dismantling is time and labor intensive. In countries where labor rates are low, dismantling of monitors is generally more cost efficient than in countries with high labor rates (e.g., the U.S.).

In the U.S., color computer monitor CRTs (and some black and white CRTs) are generally considered hazardous waste because of the CRTs' lead content. Such CRT glass is often regulated in the U.S. when it is handled, transported, processed or disposed. An exception to this regulation exists for CRT glass generated by households or small

businesses. However, the infrastructure for recycling CRT glass in the U.S. does not differ significantly according to the source or type of the glass (e.g., computer monitors used for business versus residential purposes, or color CRTs versus black and white CRTs). Instead of being discarded, most CRT glass in the U.S. is either processed to recover basic materials (e.g., silica or lead) or the glass is sorted and reprocessed to make new glass products. In any case, additional labor, transportation, processing and regulatory-related costs are incurred when CRT glass is handled in the U.S. In contrast, CRTs are not considered hazardous in many undeveloped countries and a higher demand exists for reusing whole computer monitors, so fewer handling, processing, transportation and disposal costs may be incurred.

### 4.2.4 Cost Summaries

Two alternate summaries of costs for recycling computer equipment were calculated for the San Jose pilot. Although other costs remained constant, computer monitor recycling costs varied. Two summaries of costs using different computer monitor recycling costs were calculated because:

- two monitor recycling options were available for use in the study;
- dramatic economic differences exist between the two monitor recycling options; and
- the cost of recycling monitors is one of the largest costs incurred in recycling computer equipment.

Cost Summary One involved shipping the monitors overseas to China for materials recovery. Cost Summary Two used costs for recycling monitors through U.S. vendors. Both cost summaries included transportation, processing, and monitor recycling costs. Costs associated with Summary One were $9,493 while the costs for Summary Two were $23,110. Because all other costs were constant , recycling of the monitors overseas (rather than in the U.S.) resulted in 59% lower overall costs. However, this is a summary of the costs, not the overall economics (economics = revenue – costs). Summaries of costs encountered in the San Jose pilot are provided in Tables 4.2.4.1 and 4.2.4.2.

*Table 4.2.4.1: Cost Summary One (Monitors Recycled in China)*

| Type of Cost | Cost |
|---|---|
| Transportation | $ 480 |
| Sorting & Dismantling | $ 7,500 |
| Monitor Recycling | $ 1,513 |
| Computer Recycling Costs | $ 9,493 |

*Table 4.2.4.2: Cost Summary Two (Monitors Recycled in the U.S.)*

| Type of Cost | Cost |
|---|---|
| Transportation | $    480 |
| Sorting & Dismantling | $  7,500 |
| Monitor Recycling | $ 15,130 |
| Computer Recycling Costs | $ 23,110 |

Among monitor recycling options, large U.S. industry and governmental agencies more commonly use U.S. processors. Thus, the $23,110 cost is more representative of recycling costs for computer equipment generated in the U.S. It should be noted, however, that unique characteristics such as a large, consistent volume of monitors or proximity to unique processors or markets could reduce monitor, and thus overall, recycling costs.

### 4.3 Net Economics

Because two significantly different cost summaries were used for data analysis, two sets of net economics were calculated for the San Jose collection pilot. The net economics for the first scenario (with the monitors recycled in China) came to a program cost of $4,373, or $142/ton. The net economics associated with the second scenario (monitors recycled through U.S. vendors) were a cost of $17,990, or $584/ton. A summary of the net economics is provided in the tables below.

*Table 4.3.1: Net Economics - Scenario One*
*(Monitors Recycled in China)*

| Program Costs | $  9,493 |
|---|---|
| Program Revenue | $  5,120 |
| Net Program Cost | $  4,373 |

Net Program Cost: $142/ton

*Table 4.3.2: Net Economics - Scenario Two*
*(Monitors Recycled in the U.S.)*

| Program Costs | $ 23,110 |
|---|---|
| Program Revenue | $ 5,120 |
| Net Program Cost | $ 17,990 |

Net Program Cost: $ 584/ton

Comparing the two sets of net economic figures for the San Jose pilot, Scenario One (with the monitors recycled in China) cost 76% less than Scenario Two (with the monitors recycled in the U.S.).

## 5.0 Marketing and Publicity

### 5.1 Publicity Prior to the Pilot

Several months prior to the collection pilot, publicity contacts were identified and solicited for support. Numerous groups expressed willingness to provide publicity for the collection event. Information, artwork and marketing language was provided for the following publicity:

- billboard messages (through a regional billboard management company);
- public service announcement radio spots (through local radio stations);
- press releases (local newspapers); and
- electronic equipment retail store flyers, posters and advertisements (for the retail stores participating in the pilot).

Despite a willingness of the above groups to provide the specified publicity, timing and competing marketing messages prevented most of the publicity from occurring. One mechanism that did occur was publicity of the event on the Environmental Hotline's web site. Since this web site was just coming on-line at the time of the computer collection event, however, it is unlikely that a significant amount of publicity was initially received through this avenue.

The lack of prior publicity (despite significant marketing efforts) provides useful guidance for future collection events. Lessons learned in the San Jose collection pilot include awareness that marketing efforts should be established at least six months in advance and should be monitored regularly prior to and throughout the collection event. Because of competition for free publicity and the extensive preparation time required for regional publicity, coordinators of future collection events should assume that only a fraction of marketing efforts will actually be publicized. The breadth and volume of publicity efforts can then be expanded to compensate.

### 5.2 U.S. EPA Press Event

On October 9th, a successful press event was hosted by the U.S. EPA at Store C. Dignitaries present for the event included:

- the Vice-President of the retail store;
- EPA's Regional Administrator for Region 9 (western U.S. states);
- the Vice Mayor of San Jose; and
- the Regional Coordinator for the California EPA's Department of Toxic Substance Control.

Coverage of the press event appeared on the 5:00 p.m. & 10:00 p.m. local news (TV channel 11) and on the front page of the local paper, the *San Jose Mercury News*. Anecdotal stories heard during the pilot indicated that the newspaper article was seen and discussed in several California cities outside of San Jose. A copy of the newspaper article is provided as Appendix A. Additionally, a very

13

positive and more in-depth article about the collection appeared in the *San Jose Mercury News* after the collection (on November 6th); this article was placed on the newspaper's web site, where it remained for several months. A copy of this follow-up article is provided as Appendix B.

### 5.3  Other Governmental Publicity

The day after EPA's press event, flyers about the computer collection event were distributed with San Jose employee paychecks. A copy of the paycheck flyer is included as Appendix C. Additionally, an e-mail notice about the computer collection was distributed among Santa Clara County employees. On October 12th, a U.S. EPA representative appeared on a local radio station (KOME/San Jose) for a ½ hour interview about the collection.

### 5.4  Consolidated Publicity Event

Since the EPA press event, San Jose city employee and Santa Clara county employee publicity occurred nearly simultaneously and constituted the bulk of publicity about the San Jose pilot, the activities were considered as one significant publicity event for data analysis purposes. Provided below is a graph depicting the relationship between the publicity event and the volume of computers received per week of the pilot.

*Figure 5.4: Publicity vs. Volume of Computers Received*
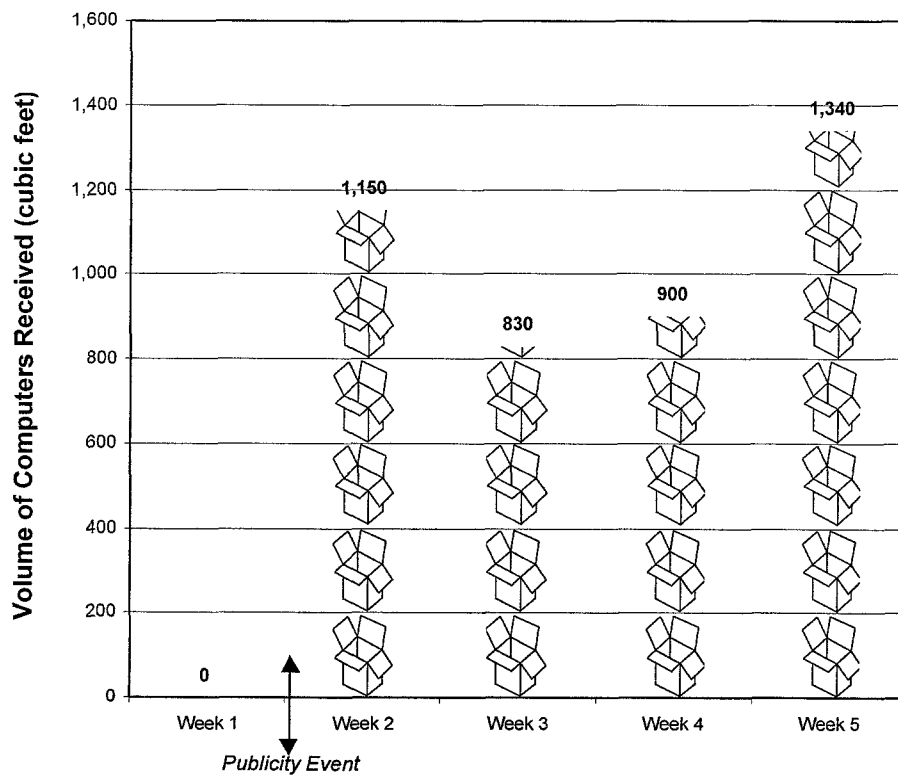
As clearly shown by the above graph, no measurable volume of equipment was collected until after the publicity event occurred. The week immediately after the publicity event, over 1,100 ft$^3$ of computer equipment was collected. The following week (when no publicity events occurred), the volume dipped downward. These numbers reflect the importance of publicity in collecting large volumes of used computer equipment.

## 5.5 Retail Store Publicity

Store C ran an advertisement about the computer collection pilot three times per week throughout the month of October. The ad was approximately two inches by three inches in size and was located in the upper right corner of their full page, four-color ad for computer equipment (see Appendix D for a simulation of the ad). Although stores A and B provided some in-house promotion through "bag stuffers" (flyers about the program placed in customer's shopping bags at checkout), Store C's advertisement was the only public promotion of the collection pilot conducted by the retail stores. As shown by the below chart, Store C collected ten times more equipment than stores A and B combined. Although other factors (e.g., store location and customer volume) could account for some of the difference in collection amount, the frequent public advertisements run by Store C (as well as Store C's visibility during the press event) appeared to significantly influence consumer participation at Store C.

### Figure 5.5: Computers Received per Retail Store



San Jose Computer Collection & Recycling Pilot

Vista Environmental™

15
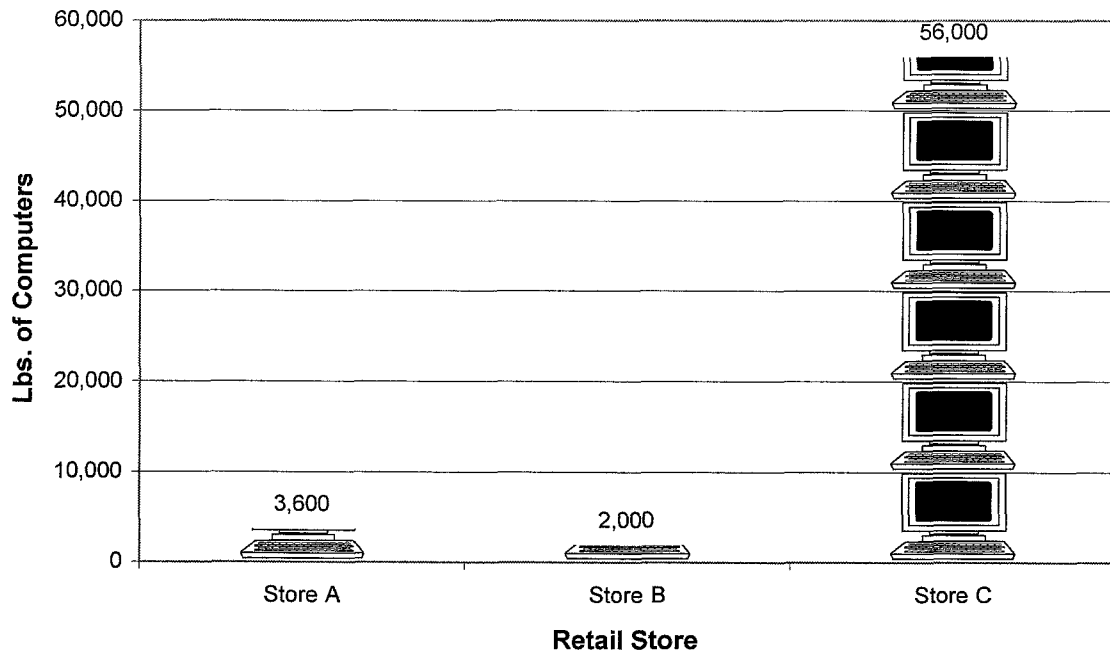
# 6.0 Barriers

During the San Jose pilot, several potential barriers to computer recycling were encountered. These barriers are described below.

## 6.1 Government Regulations

A few days before the start of the San Jose collection pilot, a state environmental agency determined that a permit variance was required for collecting and managing the used computer equipment. Considering the used computers a "non-RCRA hazardous waste," the state agency required that a permit variance be applied for and obtained before the pilot began. Although the permit variance was successfully obtained prior to the first day of collection, this last-minute government requirement almost stalled the entire project. Two weeks later, the state agency was investigating whether the permit variance was really needed.

Because of environmental regulation and regulatory related costs, the recycling of computer monitors was identified as creating barriers for the recycling of computer equipment. Because color computer monitor CRT glass is considered hazardous, management of discarded CRT glass is often considered a regulated hazardous waste activity. In some states (such as California), special approval must be obtained before some CRT glass can be handled and/or shipped. In most states, facilities that actually recycle CRT glass must have a special permit, and compliance with permit conditions typically increases facility-operating costs. Since only a limited number of CRT recycling operations exist in the U.S., CRT glass must often be shipped long distances, increasing transportation costs.

Additionally, the regulation of CRTs varies by state. In some states, special documentation, tracking and transporters must be used for certain CRT shipments. These cumbersome activities, plus personnel time spent identifying and complying with applicable regulations, also increases the cost of CRT recycling. Recycling of CRTs under a regulatory framework thus increases the effort as well as the actual cost of monitor recycling. Since monitor recycling costs were found to pose the largest portion of computer equipment recycling costs (as seen in Section 4.2.4), the regulation of CRT-containing monitors acts as a significant barrier to the recycling of computer equipment.

## 6.2 Reaction to a Voluntary Survey Form

To collect data for the San Jose pilot, a one page, graphically pleasing "Equipment Collection Form" was designed for consumer completion (see Appendix E for a copy of the form). The form was to be completed by each consumer who dropped off equipment at a participating retail store. To reduce store personnel time in managing the form, each retail store was provided with stacks of the forms, gummed at the top so customers could tear off a sheet for

16

completion. The blank forms were to be clipped to the equipment collection box and once completed, either collected by the retail store or dropped by the consumer down inside the equipment collection box. The form was purposely kept very simple and requested very little but very important information (i.e., four questions). No personal information was requested and a maximum of one minute was estimated for completion of the form.

Information that was intended to be collected through the Equipment Collection Form included:
- percent of community participation in the collection pilot;
- geographical distribution of consumers participating at each store;
- the amount of equipment brought in per consumer;
- consumer's willingness to pay for recycling of their equipment; and
- which publicity medium was most successful in informing consumers about the collection pilot.

Unfortunately, Store C decided to not use the forms. Store B placed the forms on a store pillar near the collection box but partially hidden behind merchandise. At Store A, where consumers were requested to complete the forms, 80 consumers completed the forms. Because completion of the form was voluntary and forms were only completed at one retail store, the answers provided are not considered representative of all consumers participating in the study. Thus, reaction to use of a voluntary survey became a barrier to the collection of useful data.

Among the 80 surveys completed by participants at Store A, the following data was obtained:

Willingness-to-Pay  (77 responses)
- 62%  of consumers were not willing to pay any money to help offset the cost of collecting and recycling their equipment;
- 30%  were willing to pay $1 - $5 ;
- 5%  were willing to pay $6 - $10; and
- 3%  were willing to pay > $10.

Publicity Medium  (79 responses)
- 89%  of consumers indicated they had heard about the pilot collection through the newspaper;
- 2.5% had heard from the Environmental Hotline;
- 2.5% had heard from friends;
- 1%  had heard from e-mail; and
- 5%  had heard through "other" means (e.g., radio, TV news, unsure).

It should be noted that the consumers who indicated they had heard about the pilot through the newspaper could have meant either the newspaper article

which resulted from the EPA press event, or the continuous newspaper advertisement placed by Store C. Although "store ad" was one of the survey choices for how consumers heard about the pilot, no consumer indicated this as the way they had heard about the pilot. The broader choice of "newspaper" (which appeared before "store ad") may have been considered an acceptable response for "store ad."

### 6.3 Consumer Attitudes and Store Atmosphere

Consumer attitudes encountered during the San Jose pilot varied from appreciative to resentful. These varying attitudes may have been related to customer demographics (e.g., the characteristics of customers that went to each store), perceived marketing messages (e.g., some customers heard about the experimental, cooperative nature of the pilot while others only heard that there *was* a recycling program), store atmosphere (e.g., a positive and helpful atmosphere versus an atmosphere that created a neutral or negative customer experience), or numerous other variables.

At Store C, consumers were greeted at the door by a festive décor, modern music, and a banner announcing the computer recycling program. Customer representatives are normally stationed at the store's entry so they were readily available to answer customer inquiries. In contrast, there was no visible indication of the recycling program at Stores A and B and customers had to locate and ask store personnel what to do with their equipment.

At Store A, where pilot participants were asked to complete the equipment collection survey, store personnel became disillusioned by resentful consumer attitudes. These attitudes are represented by the following reported customer statements:

- "First I brought you all this [valuable] equipment and now you want me to complete a *form*?;" and
- "I have a van full of equipment outside which I expect you [retail store personnel] to unload for me ... and I need to leave in five minutes."

Based on the lack of negative feedback at Store C and these consumer responses at Store A, it is likely that store atmosphere somewhat affected consumer attitudes toward the pilot.

In addition to an expressed resentful attitude, an expressed consumer belief was that they were giving valuable equipment to a commercial store that would be making money from recycling the equipment. Although many of the consumers truly knew better, they seemed to hold onto greatly inflated perceptions of the value of their equipment, causing them to seemingly want recognition in return for giving the used equipment to the retail store. A common customer statement at Store A was, "I need a tax receipt which shows I donated $3,000 of computer equipment to you" [$3,000 being the original purchase price of 6 year old equipment].

18

Apparently the message that this pilot was an experimental, voluntary partnership between government and private industry did not get through to some consumer participants. Unfortunately, the reportedly resentful and demanding consumer attitudes became a barrier to Store A's continuing commitment to the pilot.

6.4 Level of Corporate Support at Retail Stores

Retail store C, which overwhelmingly collected the largest volume of computer equipment, had corporate management that fully supported the collection pilot. For example, Store C consistently ran paid advertisements about the collection pilot throughout the pilot month. Also, Store C's corporate management moved the computer equipment collection box (a large, unappealing cardboard box) from behind the store's customer service station to a prominent location just inside the entry to the store. Above the box, a large sign titled "Recycle Used Computers" was hung from a 20 foot tall decorative palm tree.

In contrast, regional management for stores A and B prohibited expenditures for advertisement of the collection event and prohibited placement of the collection boxes in plain view of store customers. Although local management at stores A and B supported the collection pilot, corporate management prohibited the use of simple tools that could have increased the visibility of the pilot.

## 7.0 Computer Management Alternatives

Other options for managing the used San Jose computer equipment exist. Besides recycling the equipment through the recycler and infrastructure used for the pilot, other equipment management alternatives could have been used. A brief summary of these options follows.

### 7.1 Donation
Many people commonly believe that donation of used computer equipment to non-profit entities such as schools or public assistance organizations (e.g., Goodwill, Salvation Army) is a viable option for managing old equipment. However, since most people hold onto their computer equipment until well past its practical, useful life, many U.S. non-profit entities are not interested in older, used consumer computer equipment. An exception in the San Jose area is the Santa Clara County Computer Recycling Center, which accepts drop-off donations of computer equipment. Also, opportunities exist for donating older computer equipment to non-profit entities working in undeveloped countries.

### 7.2 Job Training Centers
Across the country, small non-profit centers are being developed to provide disadvantaged youth with training in computer repair and refurbishment. These training centers typically accept used computer equipment from both individuals and businesses, and either sell the repaired and/or refurbished equipment back into the marketplace or donate the equipment to disadvantaged schools, libraries or non-profit organizations. One such job training center, Marin Computer Resource Center, exists several counties north of San Jose, in Marin County, California.

### 7.3 Other Recyclers
Other computer recyclers exist in the San Jose area, but none of them consistently take used computers from the public. Companies which typically recycle computers from businesses, governments and institutions (and which are present in the San Jose area) include metal scrap yards, metals refiners, computer "chip" resellers, and electronic equipment recyclers.

### 7.4 Landfill
Although not all computer equipment is allowed for disposal at all municipal landfills, some landfilling of computer equipment does occur. Landfill tipping fees in the San Jose area range from $15.50 to $24.50 per cubic yard. Since 4,220 ft$^3$ of equipment was collected in the San Jose pilot and there are 27 cubic feet in a cubic yard, the tipping fee to landfill the collected computer equipment would have ranged from $2,400 to $3,800.

### 7.5 Hazardous Waste
Because some CRTs contain regulated amounts of lead, CRT glass is often

20

considered hazardous waste. Costs for disposing of hazardous waste depend on the nature of the material, the volume and location of the material, and the location and technology used by the disposing facility. The cost for managing any electronic equipment as hazardous waste is generally higher than the cost for recycling the equipment.

Although household hazardous waste (hazardous waste generated from residences) is federally exempted from hazardous waste regulations, a number of communities choose to manage the waste similar to other hazardous waste – that is, in ways perceived to be more protective of the environment. According to an EPA manual on household hazardous waste,[1] an average cost for collection and disposal of household (consumer) hazardous waste is approximately $1.00 per pound. Thus, if the CRT-containing monitors in the San Jose pilot had been collected and disposed of as household hazardous waste (such as through a household hazardous waste collection program), the cost for managing the monitors would have been approximately $33,680 compared to $15,130 for recycling the monitors in the U.S.

## 7.6 Relative Costs

As stated in Chapter Four, costs for recycling the used computer equipment in the San Jose pilot ranged from $4,373 to $17,990. These costs are substantially higher than the potential cost for landfilling all the equipment ($2,400 to $3,800). However, the cost is less than would be encountered from collecting and handling the monitors as household hazardous waste and landfilling the remaining equipment ($34,760 - $35,390). Comparative analysis of these three management options is shown below.
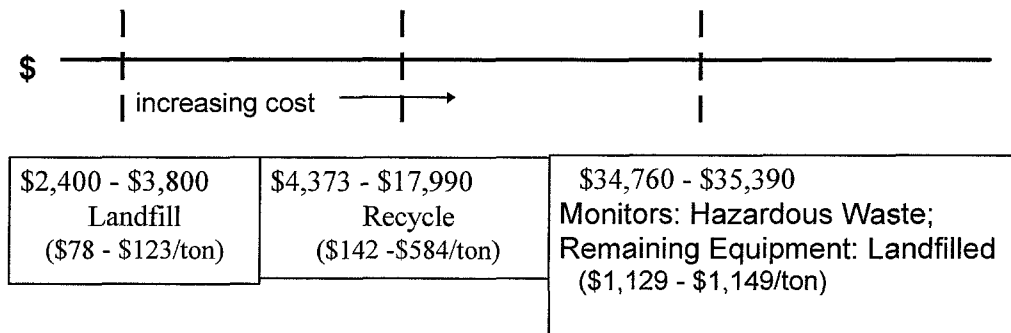


| $2,400 - $3,800 Landfill ($78 - $123/ton) | $4,373 - $17,990 Recycle ($142 -$584/ton) | $34,760 - $35,390 Monitors: Hazardous Waste; Remaining Equipment: Landfilled ($1,129 - $1,149/ton) |
|---|---|---|

*Figure 7.6:*
*Comparative Analysis of Management Options for Used Computer Equipment*

[1] "Household Hazardous Waste Management: A Manual for One-Day Community Collection Programs," EPA530-R-92-026, p. 26, August 1993.

# 8.0 Conclusions

## 8.1 Feasibility
One of the purposes for the San Jose pilot was to evaluate the feasibility of collecting used computer equipment from the public through a network of electronic retail stores. The large amount of equipment collected during the pilot despite limited marketing activities shows that the pilot's approach is feasible. A summary of economic, publicity, attitudinal and other issues identified during the pilot follow below.

## 8.2 Economics
Analysis of the San Jose pilot shows that collecting and recycling used consumer computer equipment through retail stores is feasible but the recycling can be costly. However, the fact that dramatically different costs for recycling computer monitors ($0.05 versus $0.50 per pound) were found in the study demonstrates that there is not a singular set of economics for computer recycling. The data from the San Jose Computer Collection and Recycling Pilot is one set of data using specific formats for collecting and recycling the equipment. Computer recycling economics actually depend on a number of factors, including:

- the location of the equipment in relation to the location of the equipment processors and end users;
- current market conditions for computer equipment parts and materials;
- age of the equipment;
- volume of equipment;
- the material composition of the equipment (e.g., precious materials content, use of materials compatible for disassembly, sorting and/or melting);
- technology used by the equipment processor (e.g., dismantling versus shredding; infrared sorting versus manual sorting); and
- markets used by the equipment processors (e.g., local, international, simple or sophisticated).

Additionally, electronic equipment recycling economics do not usually include non-quantifiable benefits associated with the recycling activity. Non-quantifiable benefits to program partners and the public in general should be considered in evaluating the success and viability of consumer electronic equipment collection and recycling programs. Some of these non-quantifiable benefits include:

- increased publicity for project partners;
- potential development of a positive, goodwill image in the eyes of key retail, industry and government stakeholders;
- positive government/industry/public relations;
- a new tool for bringing potential customers to retail stores;
- a new source of business for electronic equipment processors and recyclers;

22

- job creation (studies have shown that recycling creates jobs and economic opportunities; one type of job opportunity is discussed in Section 7.2);
- prevention of hazardous materials from landfill; and
- resource reutilization rather than disposal of equipment.

Although data from the San Jose pilot indicates a significant direct cost for recycling of the collected computer equipment, Store C representatives stated that they would like to work with the pilot recycler to evaluate opportunities for continuing the computer collection program on a longer-term basis. Obviously, this interest would not exist unless the store perceived benefits from the program.

## 8.3 Publicity

As clearly shown by Figure 5.4, no measurable volume of equipment was collected until after specific publicity events occurred. Additionally, the press event held at Store C and the frequent newspaper advertisements run by Store C appear to have increased the volume of consumer participation at their store (see Figure 5.5). Although experiences in the San Jose study indicate that successful program publicity can be very tenuous and requires over six months lead time, it appears that active publicity can greatly influence the volume of equipment received.

## 8.4 Attitudinal Issues and Messages

Retail store management and consumer attitudes toward computer collection and recycling programs appear to have a great potential for impacting program success. The San Jose study found that to use retail stores for equipment collection, full support is required from all levels of store management – local, regional and corporate. Store aesthetics, space, policies, loading dock usage, personnel time and marketing funds all had the potential to become barriers to the pilot. Without broad, active store management support to overcome such barriers, these issues could deflate an otherwise successful computer collection and recycling program.

As barriers developed at the participating retail stores, store personnel tended to be less enthusiastic about the program and consumers may have reacted to this perceived attitude. As mentioned in Section 6.3, some consumers at one of the stores acted resentful about the pilot and made rude comments to retail store personnel. This seemingly eroded store support for the pilot. This spiraling negativity could have perhaps been prevented through an upbeat store attitude and positive verbal and nonverbal messages to consumers.

For example, since consumer participants seemed to be in a hurry to drop off their equipment and go on their way at Stores A and B, store personnel could have offered to facilitate collection of the customer's equipment. At Store C

where store management *expected* personnel time to be expended in helping customers with their equipment, store personnel reported that customers were going on into the store (i.e., to shop) rather than rushing off. Additionally, Store C had advertised that they were participating in an experimental, cooperative pilot program while Stores A and B had not. This could account for some of the resentful customer comments reported about Store A making money off of "donated" used computer equipment.

## 8.5 Other Considerations

Future computer collections should be designed to ensure that all consumer-required data will be collected. Experience in the San Jose pilot showed that the voluntary use of a written consumer survey, no matter how simple or appealing, is not always feasible. A more mandatory approach may be required if data must be collected from consumer participants.

For the San Jose pilot, the use of a computer monitor recycler in China provided more favorable economics than typical monitor recycling scenarios in the U.S. It is beyond the scope of this report to evaluate product stewardship and public policy issues associated with the use of overseas vendors for computer recycling. However, each collector or generator of used computer equipment may wish to conduct their own evaluation of these issues. Such issues might include: public relations and image; U.S. and international government regulations; pending legislation; environmental, health and safety practices followed by recyclers; business ethics; available legal recourse in the event of international problems; familiarity with recycling processes used in other countries; business experience with companies in other countries; and long-term liability for the equipment.

# APPENDICES

## San Jose Computer Collection and Recycling Pilot

# Finally, PCs to be recycled

By Stephen Buel
Mercury News Staff Writer

They fill closets, stockrooms and, of course, garages. There are millions of them – old or dead computers –taking up space in the homes and offices of people who cling to the notion that they still have worth.

Many do retain value, but only if they fall into the hands of resellers or recyclers.

Thursday, the federal Environmental Protection Agency and a host of San Jose companies set out to make that happen, establishing the nation's first centralized collection facilities for used PCs. Through October, San Jose residents can bring their old computers to three locations for recycling as part of a pilot project.

"We have so many customers who have asked over the years what they can do with these computers in their closets," said Vice President Kathryn Kolder of Fry's Electronics, one of the project drop-off points. "In the past there hasn't been anything to tell customers, so we're very happy about it."

Computers represent one of the more daunting challenges in the recycling world.

The typical computer contains a wide range of ceramics, glass, metals and polymers that can't be easily separated. Seven different types of non-compatible plastics go into computers.

Millions of PCs are discarded in the United States each year, EPA project manager David Jones said. One estimate is 10 million.

Until Nov. 1, computers will be gathered from collection points by Berman Diversified Industries, a so-called demanufacturing facility in San Jose. Berman will resell or recycle the machines or their more valuable parts. Donors will receive nothing other than the knowledge they've done the environmentally correct thing.

The EPA's Jones said the goal of the project is to see whether a collaborative recycling effort can help create a market that would make it profitable in future years.

"Our hope is that when we run the economics, it is a viable or close-to-breaking-even enterprise," Jones said. "But it's a pilot project, and everyone was willing to take the risk that they couldn't lose too much money."

There already is a thriving small industry that resells or disassembles used computers. But stores are looking for machines with resale value, and recyclers tend to buy in bulk.

Howard Misle, owner of the City Metals Recycling scrap yard, knows about the economics of computer recycling. He started a business last year after noticing the increasing number of parts that found their way to his San Jose business.

His Allied Electronic Recovery in Union City deals with few individuals. It buys electronics in bulk from industry.

"There's got to be some pretty decent, reusable-type chips to be worth our while," Misle said. "Nobody wants a 286 or a 386 anymore, but there's still people using them."

Misle said Allied tears computers down to remove all the parts that have value, from CD-ROMs and power supplies to semiconductors and memory chips. After that, it separates out the metals with recycling value.

Many of the other materials, most notably plastics, tend to end up in a landfill. The volume of plastics disposed of annually in U.S. landfills surged by more than 300 percent between 1970 and 1994, with an increase of an additional 50 percent expected by the year 2000, according to an estimate provided by the Silicon Valley Toxics Coalition, which has worked for years to raise awareness of the problem.

EPA spokeswoman Paula Bruin said her agency has briefly tested curbside computer recycling in Boston and New York.

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IF YOU'RE INTERESTED
The drop-off points for the San Jose Computer Recycling Demonstration Program during regular business hours are Computer City at 3049 Stevens Creek Blvd., Fry's Electronics at 550 E. Brokaw Road and OfficeMax at 3530 Stevens Creek Blvd.

Appendix B:    11/5/97  Article from the San Jose Mercury News

# Computer recycling shows promise in test run

＊ Graphic: Life cycle of a dead computer

By STEPHEN BUEL
Mercury News Staff Writer

The folks in charge of a trial program to recycle computers had wondered whether public response would justify the monthlong effort. Thirty-one tons gave them their answer.

That was the amount of discards turned in during the federal pilot project in Santa Clara County. Sponsors say the amazing response bodes well for the future of efforts to reduce wastes from used electronics.

Mark Larsh learned all he needed to know about the need for the service when a 48-foot trailer pulled up outside his Office Max store -- one of three collection sites -- with a load of used computers to donate.

"It's been phenomenally successful from our end," said Larsh, manager of the store on Stevens Creek Boulevard in San Jose. "We expected lamps and things like that, but we got exactly what we asked for."

Program participants, including a computer industry representative, will meet Wednesday to discuss the idea's future. Although a final decision isn't likely until later in the month, participants agreed that some ongoing recycling program is likely to emerge.

Recyclers saw the waste products revenue potential, and retailers apparently found that they could sell new computers to people who'd just relinquished old ones.

"It was very good for them," recycler Allan Berman said of Fry's Electronics. "I think we can work something out for both of us to be happy."

But retailers and recyclers aren't the or,ly industries with a vested interest. Computer manufacturers have a stake, too.

They are anxious to help devise a voluntary system so government officials won't impose a mandatory one. Several European nations have done just that, and county governments in New Jersey and Minnesota are considering the same thing.

"Eventually, its going to come," said Tom Bartel, environmental affairs manager for Unisys Corp., where next weeks meeting will take place. "So we want to be involved."

## Mission accomplished

Although pilot sponsors aren't sure whether the phenomenal response was a one-time fluke or a broad trend, project manager David Jones of the Environmental Protection Agency said the test accomplished its two major goals.

The first was to assess demand. The second was to obtain a large-enough sample of discards to be able to reliably project how cost-effective PC recycling could be.

"We verified that people want to responsibly get rid of these things," Jones said "People have been storing them in their attics and their garages and their basements, waiting for opportunities like this. ... And we definitely got enough volume."

While 31 tons -- a couple thousand computers -- may sound like a lot of discards, it's a pittance. As many as 10 million PCs are thrown away each year in the United States, but domestic sales exceeded 25 million units last year, according to Dataquest PC analyst Erin Collier. Where the rest go is anybody's guess.

From the three stores that served as collection sites -- Office Max, Fry's and Computer City--the computers were taken to Berman's Diversified Industries, a San Jose firm that transformed itself from a conventional scrap dealer into a specialized electronics recycling firm.

The discards were functional but obsolete 286 and 386 machines, old AT and XT models with 5 I/4-inch disk drives, black-and-white monitors and, of course, dot-matrix printers.

"We knew this is what it would look like," Berman said.

Although discards of this type are potentially lucrative, Jerry Canaday, Berman's director of procurement, said the monthlong test was probably unprofitable for his company. One reason was an EPA restriction prohibiting Berman's from sending any of its wastes overseas.

Canaday said disassembly of circuit boards and computer housings is profitable only when the intensive labor costs can be kept low. Typically, after his company resells entire computers, large components such as keyboards or disk drives and smaller items such as chips, the company ships the remainder abroad. Ultimately, the pieces are melted down for their raw materials.

For the purposes of the one-month trial, Berman's agreed to do all its own disassembly. But now that the pilot program is over, Jones said he expects participants to suggest cheaper ways to recycle in the future.

Berman said he believes some form of subsidy will be necessary to kick-start widespread computer recycling. After all, he said, subsidies have helped establish markets for other recycled commodities, from aluminum cans to newsprint.

## Buffeted by Change

The market for recycled computer parts already has changed radically since his company entered the business. The drop in gold prices during the late 1980s cut 30 to 40 percent from his company's revenues by reducing the income from recycling the gold plating on circuit boards. Then in 1995, the collapse in computer memory prices eliminated another revenue source.

"We couldn't fathom how quickly that market collapsed," he said.

Going forward with recycling, another big challenge will be finding a way to handle pickup of used computers. Berman said the three retailers were besieged with calls.

"That's why we stay away from the public," he confided.

Retailers might want to keep collecting the machines as a way to attract potential computer buyers, Jones said. But local waste-management officials also could

schedule special days for curbside electronics disposal.

A few secondary impediments also remain. Federal hazardous-waste regulations make it extremely costly to dispose of the picture tubes in computer monitors because the glass contains lead, a toxic substance.

So the EPA plans to take a look at its own regulations to see how it can help pave the way for recycling.

"Hopefully its win-win-win-win here -- for the stores, for the consumers, for the industry and the environment," Bartel of Unisys said.

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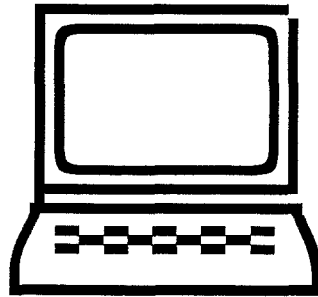
**DO YOU HAVE AN OLD COMPUTER HANGIN' AROUND HOME
THAT YOU DON'T KNOW WHAT TO DO WITH??**

**IS THERE A CPU HIDING IN YOUR CLOSET?**

**HERE'S YOUR CHANCE.....
RECYCLE YOUR OLD COMPUTER DURING OCTOBER!**

San Jose has been selected as the site for a computer recycling pilot project during the month of October. The pilot is sponsored by the U.S. Environmental Protection Agency, in partnership with the City of San Jose and several other organizations. The recycling of computers decreases landfill use and prevents dangerous heavy metals from entering the environment.

During the pilot project, used home computer equipment (full computers, monitors, boards, etc.) will be accepted for recycling at the three partner stores, Fry's Electronics, Computer City, and Office Max. If you're a San Jose resident and you have an old computer you'd like to recycle, take it to the nearest retail location in San Jose.

For more information on this exciting program, or to find out which retail location is nearest you, call US EPA's Environmental Hotline at 1-800-CLEANUP.

**Thanks for helping to preserve the environment!**

**Approved for Distribution**
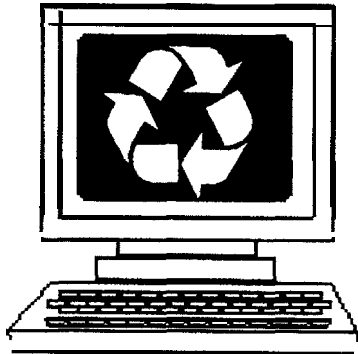
**RECYCLE YOUR OLD COMPUTER**

THROUGHOUT THE MONTH OF OCTOBER, [STORE NAME] IS PARTICIPATING IN
A U.S. EPA SPONSORED DEMONSTRATION PROJECT KNOWN AS THE SAN JOSE
COMPUTER RECYCLING PROJECT. IF YOU HAVE USED COMPUTER EQUIPMENT
AND WOULD LIKE TO PARTICIPATE IN THIS COMMUNITY RECYCLING EFFORT
PLEASE BRING IT TO YOUR [STORE]'S SAN JOSE LOCATION.
PROMOTION DURING THE MONTH OF OCTOBER ONLY.

# San Jose Computer Collection Pilot

## Equipment Collection Form

October, 1997
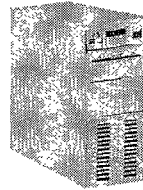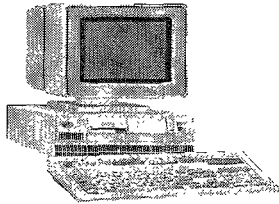
Please Indicate the Number of Items Brought In:

_____ CPUs (computer box/tower, etc.)

_____ monitors

_____ keyboards

_____ printers

_____ peripherals (mouse, cords, external storage devices & backup systems ...)

_____ internal computer parts (disk/hard drives, floppy drives, CD-Roms, power supplies, cards & chips, mother boards, fans ...)

_____ other (specify) _____

Your Zip Code is: _____

How did you hear about this pilot collection program?

Flyer _____    Newspaper _____    Store Ad _____    Email _____

Friend _____    1-800-Cleanup (Hotline) _____    Other _____

To help offset the costs of collection and recycling, would you be willing to pay to drop off your equipment ?    Yes _____    No ___

   If yes, how much per drop-off?    $1-5 ___    $6-10 ___    > $10 ___

The results of this pilot collection will help us determine the costs and benefits of recycling electronic equipment.  If you have multiple computers to recycle, please call Berman's Diversified Industries at (408) 955-7908 to drop off equipment directly. Thanks for your participation!